Abstract Submitted
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Explosions in uncertain hydrogen-oxygen mixtures JAVIER URZAY, NICOLAS KSEIB, Center for Turbulence Research, Stanford University, DAVID F. DAVIDSON, High-Temperature Gasdynamics Laboratory, Stanford University, GIANLUCA IACCARINO, Center for Turbulence Research, Stanford University, RON K. HANSON, High-Temperature Gasdynamics Laboratory, Stanford University — Uncontrolled residuals abound in combustors as a result of complex chemistry. The question to answer here is: How can we give a measure of the explosive tendency of a gaseous mixture when the initial composition is not known with absolute certainty? This study addresses the influences of uncertain amounts of residual radical impurities, namely H, O, OH and HO2 radicals, on the calculation and experimental determination of autoignition times in H2-O2 mixtures. To illustrate this point, shock-tube data is obtained in which the presence of residual radicals is evidenced by i) the detection of trace amounts of OH radicals in initial oxygen-argon mixtures and ii) the need of shortening the autoignition times calculated after integrations of the conservation equations when matching with experimental kinetics data. Regime diagrams of autoignition catalyzed by impurities above and below crossover are proposed, thereby summarizing the potential effects of residual dirt in shock-tube experiments and calculations. An experimentally-inspired model based on Bayesian inference is proposed for the uncertainty in the H-atom impurities in shock tubes. Monte-Carlo calculations of the conservation equations are performed using this model to assess the induced variabilities in the autoignition time.

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